

THE OPERATIONAL ANALYSIS OF PSYCHOLOGICAL TERMS

BY B. F. SKINNER

University of Minnesota

An answer to Question 6 will define the position to be taken in what follows. Operationism is not regarded as a new theory or mode of definition. The literature has emphasized certain critical or hitherto neglected instances, but no new kind of operation has been discovered and none should be singled out. There is no reason to restrict operational analysis to high-order constructs; the principle applies to all definitions (Question 9). This means, in answer to Question 1 (a), that we must explicate an operational definition for every term unless we are willing to adopt the vague usage of the vernacular.

Operationism may be defined as the practice of talking about (1) one's observations, (2) the manipulative and calculational procedures involved in making them, (3) the logical and mathematical steps which intervene between earlier and later statements, and (4) *nothing else*. So far, the major contribution has come from the fourth provision and, like it, is negative. We have learned how to avoid troublesome references by showing that they are artifacts, which may be variously traced to history, philosophy, linguistics, and so on. No very important positive advances have been made in connection with the first three provisions because operationism has no good answer to Question 10. It has not developed a satisfactory formulation of the effective verbal behavior of the scientist.

The operationist, like most contemporary writers in the field of linguistic and semantic analysis, is on the fence between logical 'correspondence' theories of reference and empirical formulations

of language in use. He has not improved upon the mixture of logical and popular terms usually encountered in casual or even supposedly technical discussions of scientific method or the theory of knowledge (e.g., Bertrand Russell's recent *An inquiry into meaning and truth*). 'Definition' is a key term but is not rigorously defined. Bridgman's original contention that the 'concept is synonymous with the corresponding set of operations' cannot be taken literally, and no similarly explicit but satisfactory statement of the relation is available. Instead, a few roundabout expressions recur with rather tiresome regularity whenever this relation is mentioned. We are told that a concept is to be defined '*in terms of*' certain operations, that propositions are to be '*based upon*' operations, that a term denotes something only when there are '*concrete criteria for its applicability*,' that operationism consists in '*referring any concept for its definition to . . . concrete operations . . .*,' and so on. We may accept expressions of this sort as outlining a program, but they do not provide a general scheme of definition, much less an explicit statement of the relation between concept and operation.

The weakness of current theories of language may be traced to the fact that an objective conception of human behavior is still incomplete. The doctrine that words are used to express or convey meanings merely substitutes 'meaning' for 'idea' (in the hope that meanings can then somehow be got outside the skin) and is incompatible with modern psychological conceptions of the organism. Attempts to derive a symbolic

function from the principle of conditioning (or association) have been characterized by a very superficial analysis. It is simply not true that an organism reacts to a sign 'as it would to the object which the sign supplants' (Stevens, 2, p. 250). Only in a very limited area (mainly in the case of autonomic responses) is it possible to regard the sign as a simple substitute stimulus in the Pavlovian sense. Modern logic, as a formalization of 'real' languages, retains and extends this dualistic theory of meaning and can scarcely be appealed to by the psychologist who recognizes his own responsibility in giving an account of verbal behavior.

It is not my intention to attempt a more adequate formulation here. The fundamental revision is too sweeping to be made hastily. I should like, however, to try to make a small but positive contribution to this symposium by considering a few points which arise in connection with the operational definition of psychological terms. Much of the material which follows is adapted from a much longer work now in preparation, in which the necessary groundwork is more carefully prepared.

The operational attitude, in spite of its shortcomings, is a good thing in any science but especially in psychology because of the presence there of a vast vocabulary of ancient and non-scientific origin. It is not surprising that the broad empirical movement in the philosophy of science, which Stevens has shown (2) to be the background of operationism, should have had a vigorous and early representation in the field of psychology—namely, behaviorism. In spite of the differences which Stevens pretends to find, behaviorism has been (at least to most behaviorists) nothing more than a thoroughgoing operational analysis of traditional mentalistic concepts. We may disagree with some of the answers (such as Watson's disposi-

tion of images), but the *questions* asked by behaviorism were strictly operational in spirit. I also cannot agree with Stevens that American behaviorism was 'primitive.' The early papers on the problem of consciousness by Watson, Weiss, Tolman, Hunter, Lashley, and many others, were not only highly sophisticated examples of operational inquiry, they showed a willingness to deal with a wider range of phenomena than do current streamlined treatments, particularly those offered by logicians (e.g., Carnap) interested in a unified scientific vocabulary.) But behaviorism, too, stopped short of a decisive positive contribution—and for the same reason: it never finished an acceptable formulation of the 'verbal report.' The conception of behavior which it developed could not convincingly embrace the 'use of subjective terms.'

A considerable advantage is gained from dealing with terms, concepts, constructs, and so on, quite frankly in the form in which they are observed—namely, as verbal responses. There is then no danger of including in the concept that aspect or part of nature which it singles out. (Several of the present questions seem to mix concept and referent; at least they seem to become trivial when, in order to make the mixture less likely, 'term' is substituted for 'concept' or 'construct.') Meanings, contents, and references are to be found among the determiners, not among the properties, of response. The question 'What is length?' would appear to be satisfactorily answered by listing the circumstances under which the response 'length' is emitted (or, better, by giving some general description of such circumstances). If two quite separate sets of circumstances are revealed, then there are two responses having the form 'length' (Question 2), since a verbal response-class is not defined by phonetic form alone but by its functional rela-

tions. This is true even though the two sets are found to be intimately connected. The two responses are not controlled by the same stimuli, no matter how clearly it is shown that the different stimuli arise from the same 'thing.'

What we want to know in the case of many traditional psychological terms is, first, the specific stimulating conditions under which they are emitted (this corresponds to 'finding the referents') and, second (and this is a much more important systematic question), why each response is controlled by its corresponding condition. The latter is not necessarily a genetic question. The individual acquires language from society, but the reinforcing action of the verbal community continues to play an important rôle in maintaining the specific relations between responses and stimuli which are essential to the proper functioning of verbal behavior. How language is acquired is, therefore, only part of a much broader problem.

We may generalize the conditions responsible for the standard 'semantic' relation between a verbal response and a particular stimulus without going into reinforcement theory in detail. There are three important terms: a stimulus, a response, and a reinforcement supplied by the verbal community. (All of these need more careful definitions than are implied by current usage, but the following argument may be made without digressing for that purpose.) The significant interrelations between these terms may be expressed by saying that the community reinforces the response only when it is emitted in the presence of the stimulus. The reinforcement of the response 'red,' for example, is contingent upon the presence of a red object. (The contingency need not be invariable.) A red object then becomes a discriminative stimulus, an 'occasion,' for the successful emission of the response 'red' (1).

This scheme presupposes that the stimulus act upon both the speaker and the reinforcing community; otherwise the proper contingency cannot be maintained by the community. But this provision is lacking in the case of many 'subjective' terms, which appear to be responses to *private* stimuli. The problem of subjective terms does not coincide exactly with that of private stimuli, but there is a close connection. We must know the characteristics of verbal responses to private stimuli in order to approach the operational analysis of the subjective term.

The response 'My tooth aches' is partly under the control of a state of affairs to which the speaker alone is able to react, since no one else can establish the required connection with the tooth in question. There is nothing mysterious or metaphysical about this; the simple fact is that each speaker possesses a small but important private world of stimuli. So far as we know, his reactions to these are quite like his reactions to external events. Nevertheless the privacy gives rise to two problems. The first difficulty is that we cannot, as in the case of public stimuli, account for the verbal response by pointing to a controlling stimulus. Our practice is to *infer* the private event, but this is opposed to the direction of inquiry in a science of behavior in which we are to predict response through, among other things, an independent knowledge of the stimulus. It is often supposed that a solution is to be found in improved physiological techniques. Whenever it becomes possible to say what conditions within the organism control the response 'I am depressed,' for example, and to produce these conditions at will, a degree of control and prediction characteristic of responses to external stimuli will be made possible. Meanwhile, we must be content with reasonable evidence for the belief that

responses to public and private stimuli are equally lawful and alike in kind.

But the problem of privacy cannot be wholly solved by instrumental invasion. No matter how clearly these internal events may be exposed in the laboratory, the fact remains that in the normal verbal episode they are quite private. We have not solved the second problem of how the community achieves the necessary contingency of reinforcement. How is the response 'toothache' appropriately reinforced if the reinforcing agent has no contact with the tooth? There is, of course, no question of whether responses to private stimuli are possible. They occur commonly enough and must be accounted for. But why do they occur, what is their relation to controlling stimuli, and what, if any, are their distinguishing characteristics?

There are at least four ways in which a verbal community which has no access to a private stimulus may generate verbal behavior in response to it:

(1) It is not strictly true that the stimuli which control the response must be available to the community. Any reasonably regular accompaniment will suffice. Consider, for example, a blind man who learns the names of a trayful of objects from a teacher who identifies the objects by sight. The reinforcements are supplied or withheld according to the contingency between the blind man's responses and the teacher's visual stimuli, but the responses are controlled wholly by tactual stimuli. A satisfactory verbal system results from the fact that the visual and tactual stimuli remain closely connected.

Similarly, in the case of private stimuli, one may teach a child to say 'That hurts' in agreement with the usage of the community by making the reinforcement contingent upon public accompaniments of painful stimuli (a smart blow, tissue damage, and so on). The connection between public and

private stimuli need not be invariable; a response may be conditioned with merely periodic reinforcement and even in spite of an occasional conflicting contingency (1). The possibility of such behavior is limited by the degree of association of public and private stimuli which will supply a net reinforcement sufficient to establish and maintain a response.

(2) A commoner basis for the verbal reinforcement of a response to a private stimulus is provided by collateral responses to the same stimulus. Although a dentist may occasionally be able to identify the stimulus for a toothache from certain public accompaniments as in (1), the response 'toothache' is generally transmitted on the basis of responses which are elicited by the same stimulus but which do not need to be set up by an environmental contingency. The community infers the private stimulus, not from accompanying public stimuli, but from collateral, generally unconditioned and at least non-verbal, responses (hand to jaw, facial expressions, groans, and so on). The inference is not always correct, and the accuracy of the reference is again limited by the degree of association.

(3) Some very important responses to private stimuli are descriptive of the speaker's own behavior. When this is overt, the community bases its instructional reinforcement upon the conspicuous manifestations, but the speaker presumably acquires the response in connection with a wealth of additional proprioceptive stimuli. The latter may assume practically complete control, as in describing one's own behavior in the dark. This is very close to the example of the blind man; the speaker and the community react to different, though closely associated, stimuli.

Suppose, now, that a given response recedes to the level of covert or merely incipient behavior. How shall we ex-

plain the vocabulary which deals with this private world? (The instrumental detection of covert behavior is again not an answer, for we are interested in how responses to private stimuli are normally, and non-instrumentally, set up.) There are two important possibilities. The surviving covert response may be regarded as an accompaniment of the overt (perhaps part of it), in which case the response to the private stimulus is imparted on the basis of the public stimulus supplied by the overt response, as in (1). On the other hand, the covert response may be *similar to*, though probably less intense than, the overt and hence supply the *same* stimulus, albeit in a weakened form. We have, then, a third possibility: a response may be emitted in the presence of a private stimulus, which has no public accompaniments, provided it is occasionally reinforced in the presence of the same stimulus occurring with public manifestations.

Terms falling within this class are apparently descriptive only of behavior, rather than of other internal states or events, since the possibility that the same stimulus may be both public and private (or, better, may have or lack public accompaniments) seems to arise from the unique fact that behavior may be both covert and overt.

(4) The principle of transfer or stimulus induction supplies a fourth explanation of how a response to private stimuli may be maintained by public reinforcement. A response which is acquired and maintained in connection with public stimuli may be emitted, through induction, in response to private events. The transfer is not due to identical stimuli, as in (3), but to coinciding properties. Thus, we describe internal states as 'agitated,' 'depressed,' 'ebullient,' and so on, in a long list. Responses in this class are all metaphors (including special figures like meto-

nomy). The term 'metaphor' is not used pejoratively but merely to indicate that the differential reinforcement cannot be accorded actual responses to the private case. As the etymology suggests, the response is 'carried over' from the public instance.

In summary, a verbal response to a private stimulus may be maintained in strength through appropriate reinforcement based upon public accompaniments or consequences, as in (1) and (2), or through appropriate reinforcement accorded the response when it is made to public stimuli, the private case occurring by induction when the stimuli are only partly similar. If these are the only possibilities (and the list is here offered as exhaustive), then we may understand why terms referring to private events have never formed a stable and acceptable vocabulary of reasonably uniform usage. This historical fact is puzzling to adherents of the 'correspondence school' of meaning. Why is it not possible to assign names to the diverse elements of private experience and then to proceed with consistent and effective discourse? The answer lies in the process by which 'terms are assigned to private events,' a process which we have just analyzed in a rough way in terms of the reinforcement of verbal responses.

None of the conditions that we have examined permits the sharpening of reference which is achieved, in the case of public stimuli, by a precise contingency of reinforcement. In (1) and (2) the association of public and private events may be faulty; the stimuli embraced by (3) are of limited scope; and the metaphorical nature of those in (4) implies a lack of precision. It is, therefore, impossible to establish a rigorous scientific vocabulary for public use, nor can the speaker clearly 'know himself' in the sense in which knowing is identified with behaving discrimina-

tively. In the absence of the 'crisis' provided by differential reinforcement (much of which is necessarily verbal), private stimuli cannot be analysed. (This has little or nothing to do with the availability or capacity of receptors.)

The contingencies we have reviewed also fail to provide an adequate check against fictional distortion of the relation of reference (e.g., as in rationalizing). Statements about private events may be under control of the drives associated with their consequences rather than antecedent stimuli. The community is skeptical of statements of this sort, and any attempt by the speaker to talk to himself about his private world (as in psychological system making) is fraught with self-deception.

Much of the ambiguity of psychological terms arises from the possibility of alternative or multiple modes of reinforcement. Consider, for example, the response 'I am hungry.' The community may reinforce this on the basis of the history of ingestion, as in (1), or collateral behavior associated with hunger, as in (2), or as a description of behavior with respect to food, or stimuli previously correlated with food, as in (3). In addition the speaker has (in some instances) the powerful stimulation of hunger pangs, which is private, since the community has no suitable connection with the speaker's stomach. 'I am hungry' may therefore be variously translated as 'I have not eaten for a long time' (1), or 'That food makes my mouth water' (2), or 'I am ravenous' (3) (compare the expression 'I was hungrier than I thought' which describes the ingestion of an unexpectedly large amount of food), or 'I have hunger pangs.' While all of these may be regarded as synonymous with 'I am hungry,' they are not synonymous with each other. It is easy for conflicting psychological systematists to

cite supporting instances or to train speakers to emit the response 'I am hungry' in conformity with a system. With the balloon technique one might condition the verbal response exclusively to stimulation from stomach contractions. This would be an example of either (1) or (2) above. Or a speaker might be trained to make nice observations of the strength of his ingestive behavior, which might recede to the covert level as in (3). The response 'I am hungry' would then describe a tendency to eat, with little or no reference to stomach contractions. Everyday usage reflects a mixed reinforcement. A similar analysis could be made of all terms descriptive of motivation, emotion, and action in general, including (of special interest here) the acts of seeing, hearing, and so on.

When public manifestations survive, the extent to which the private stimulus takes over is never certain. In the case of a toothache, the private event is no doubt dominant, but this is due to its relative intensity, not to any condition of differential reinforcement. In a description of one's own behavior, the private component may be much less important. A very strict external contingency may emphasize the public component, especially if the association with private events is faulty. In a rigorous scientific vocabulary private effects are practically eliminated. The converse does not hold. There is apparently no way of basing a response entirely upon the private part of a complex of stimuli. *A differential reinforcement cannot be made contingent upon the property of privacy.* This fact is of extraordinary importance in evaluating traditional psychological terms.

The response 'red' is imparted and maintained (either casually or professionally) by reinforcements which are contingent upon a certain property of stimuli. Both speaker and community

(or psychologist) have access to the stimulus, and the contingency may be made quite precise. There is nothing about the resulting response that should puzzle anyone. The greater part of psychophysics rests upon this solid footing. The older psychological view, however, was that the speaker was reporting, not a property of the stimulus, but a certain kind of private event, the sensation of red. This was regarded as a later stage in a series beginning with the red stimulus. The experimenter was supposed to manipulate the private event by manipulating the stimulus. This seems like a gratuitous distinction, but in the case of some subjects a similar later stage could apparently be generated in other ways (by arousing an 'image'), and hence the autonomy of a private event capable of evoking the response 'red' in the absence of a controllable red stimulus seemed to be proved. An adequate proof, of course, requires the elimination of other possibilities (e.g., that the response is generated by the procedures which are intended to generate the image).

Verbal behavior which is 'descriptive of images' must be accounted for in any adequate science of behavior. The difficulties are the same for both behaviorist and subjectivist. If the private events are free, a scientific description is impossible in either case. If laws can be discovered, then a lawful description of the verbal behavior can be achieved, with or without references to images. So much for 'finding the referents;' the remaining problem of how such responses are maintained in relation to their referents is also soluble. The description of an image appears to be an example of a response to a private stimulus of class (1) above. That is to say, relevant terms are established when the private event accompanies a controllable external stimulus, but responses occur at other times, perhaps in

relation to the same private event. The deficiencies of such a vocabulary have been pointed out.

We can account for the response 'red' (at least as well as for the 'experience' of red) by appeal to past conditions of reinforcement. But what about expanded expressions like '*I see red*' or '*I am conscious of red*'? Here 'red' may be a response to either a public or a private stimulus without prejudice to the rest of the expression, but 'see' and 'conscious' seem to refer to events which are by nature or by definition private. This violates the principle that a reinforcement cannot be made contingent upon the privacy of a stimulus. A reference cannot be narrowed down to a specifically private event by any known method of differential reinforcement.

The original behavioristic hypothesis was, of course, that terms of this sort were descriptions of one's own (generally covert) behavior. The hypothesis explains the establishment and maintenance of the terms by supplying natural public counterparts in similar overt behavior. The terms are in general of class (3). One consequence of the hypothesis is that each term may be given a behavioral definition. We must, however, modify the argument slightly. To say '*I see red*' is to react, not to red (this is a trivial meaning of 'see'), but to one's reaction to red. 'See' is a term acquired with respect to one's own behavior in the case of overt responses available to the community. But according to the present analysis it may be evoked at other times by *any private accompaniment* of overt seeing. Here is a point at which a non-behavioral private seeing may be slipped in. Although the commonest private accompaniment would appear to be the stimulation which survives in a similar covert act, as in (3), it might be some sort of state or condition which gains control of the response as in (1) or (2).

The superiority of the behavioral hypothesis is not merely methodological. That aspect of seeing which can be defined behaviorally is basic to the term as established by the verbal community and hence most effective in public discourse. A comparison of cases (1) and (3) will also show that terms which recede to the private level as overt behavior becomes covert have an optimal accuracy of reference, as responses to private stimuli go.

The additional hypothesis follows quite naturally that being conscious, as a form of reacting to one's own behavior, is a social product. Verbal behavior may be distinguished, and conveniently defined, by the fact that the contingencies of reinforcement are provided by other organisms rather than by a mechanical action upon the environment. The hypothesis is equivalent to saying that it is only because the behavior of the individual is important to society that society in turn makes it important to the individual. The individual becomes aware of what he is doing only after society has reinforced verbal responses with respect to his behavior as the source of discriminative stimuli. The behavior to be described (the behavior of which one is to be aware) may later recede to the covert level, and (to add a crowning difficulty) so may the verbal response. It is an ironic twist, considering the history of the behavioristic revolution, that as we develop a more effective vocabulary for the analysis of behavior we also enlarge the possibilities of awareness, so defined. The psychology of the other one is, after all, a direct approach to 'knowing thyself.'

The main purpose of this discussion has been to answer Question 10 by example. To be consistent the psychologist must deal with his own verbal practices by developing an empirical science of verbal behavior. He cannot, unfortunately, join the logician in defining a definition, for example, as a 'rule for the use of a term' (Feigl); he must turn instead to the contingencies of reinforcement which account for the functional relation between a term, as a verbal response, and a given stimulus. This is the 'operational basis' for his use of terms; and it is not logic but science.

The philosopher will call this circular. He will argue that we must adopt the rules of logic in order to make and interpret the experiments required in an empirical science of verbal behavior. But talking about talking is no more circular than thinking about thinking or knowing about knowing. Whether or not we are lifting ourselves by our own bootstraps, the simple fact is that we *can* make progress in a scientific analysis of verbal behavior. Eventually we shall be able to include, and perhaps to understand, our own verbal behavior as scientists. If it turns out that our final view of verbal behavior invalidates our scientific structure from the point of view of logic and truth-value, then so much the worse for logic, which will also have been embraced by our analysis.

REFERENCES

1. SKINNER, B. F. *The behavior of organisms: an experimental analysis*. New York: D. Appleton-Century Co., 1938.
2. STEVENS, S. S. Psychology and the science of science. *Psychol. Bull.*, 1939, 36, 221-263.